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PREVENTION & REHABILITATION: LITERATURE REVIEW

Muscle strengthening activities and fibromyalgia: A review of pain and strength outcomes

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Summary *Objective:* The primary aim of this review was to investigate whether fibromyalgia (FM) patients can engage in sufficient muscle strengthening activity (MSA) to elicit positive strength and functional outcomes, while not exacerbating pain. The second aim was to report strength training recommendations based upon the findings of this review.
Methods: Studies published between January 1, 2000 and May 1, 2014 were located using the electronic databases CINHAL, PubMed and Google Scholar. Studies were included if a strength training component (e.g. resistance machines, bodyweight, exercise tubing, dumbbells) was part of the intervention, and if the investigation reported pain and/or strength outcomes. A total of eleven comparative controlled trials were included in this review.
Results: The majority of the studies demonstrated encouraging increases in strength, along with significant reductions in pain.
Conclusions: MSA can be a safe and effective mode of exercise for FM patients, particularly when progressed from low intensities.

1. Introduction

Fibromyalgia (FM) is an idiopathic syndrome characterized by chronic widespread pain, fatigue, sleep disturbances, muscular strength loss, muscle stiffness and cognitive issues (Wolfe et al., 1990). The prevalence of FM has been reported to be 2–5% among the general population (Pereira et al., 2009). Fibromyalgia imposes a large socio-economic burden largely due to loss of physical function, reductions of quality of life, and missed work (Pereira et al., 2009). Case-control studies have demonstrated than those with FM are less physically active, have significantly lower perceived functional ability and demonstrate impaired physical performance (McLoughlin et al., 2011; Jones et al., 2010). Furthermore, epidemiologic data show that fibromyalgia patients have a higher prevalence of obesity (40%) and overweight (30%) when compared with healthy individuals (Ursini et al., 2011). The

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pervasiveness of sedentary lifestyles and obesity among those with FM, places this population at risk for several chronic diseases, thereby creating a demand for effective exercise recommendations. Although, many clinicians strongly encourage physical activity (PA), there is little consensus as to which modalities may be best suited for this population. Many studies have investigated the efficacy of low intensity, aerobic modalities, with recent systematic reviews reporting "moderate quality evidence" demonstrating that short-term programs of supervised aerobic exercise produce important benefits including improvements in physical function and reduction in pain (Hauser et al., 2010a; Brosseau et al., 2008; Busch et al., 2008). Until recently, few studies have investigated the effects of muscle strengthening activity (MSA) on the signature symptoms of FM. The reason for this may have been due to early research contending that FM patients might have structural alterations within muscles fibers (Sprott et al., 2004; Drewes et al., 1993), abnormalities in microcirculatory capillaries (Morf et al., 2005), and irregularities in muscle metabolism (McIver et al., 2006; Sprott et al., 2004; Park et al., 1998). Collectively, these analyses prompted concerns that MSA may augment muscle damage and widespread pain.

Muscular strength is one of the five health-related components of physical fitness (ACSM, 2009). Strength is needed to accomplish many activities of daily living and functional tasks, such as walking, climbing stairs, and lifting and carrying objects. The development of strength through MSA is also believed to assist in the prevention and management of debilitating health conditions (e.g. sarcopenia and osteoporosis) and chronic diseases (e.g. cardiovascular disease, diabetes and obesity) (ACSM, 2009). For these reasons, the American College of Sports Medicine (ACSM) recommends that MSA be performed two to three days per week and include every major muscle group.

The primary aim of this study was to investigate whether FM patients can engage in sufficient MSA intensities to elicit positive strength and functional outcomes, without exacerbating pain. Based on these findings, the second aim was to report recommendations for strength training exercise prescription. Comparative controlled trials published between January 1, 2000 and May 1, 2014 were considered for this review. Studies reporting the outcomes of pain and/or strength, and having a minimum sample of 10 participants in each group were included. Studies involving participants with FM in an MSA treatment group or a comparison group were included, as were experimental studies comparing the effects of MSA in those with FM to healthy subjects participating in MSA. A strengthening exercise was defined as an isometric, isokinetic, or concentric/eccentric resistance exercise with the purpose of increasing the maximal force generated by a specific muscle or muscle group (Balady et al., 2000). Based on the inclusion criteria, a total of eleven comparative controlled trials were ultimately found relevant and included in this review.

2. Key findings (see Table 1 for a summary of pain and strength outcomes)

2.1. Pain

Table 1 Pain outcomes were commonly measured by the pain visual analog scale (VAS), the number of tender points, or by tender point sensitivity. Eight studies compared pain outcomes among FM patients performing MSA to FM patients randomized to a comparison group. Among the eight investigations, seven found either between-group or within-group reductions in pain (Gavi et al., 2014; Hooten et al., 2012; Kayo et al., 2012; Valkeinen et al., 2008; Bircan et al., 2008; Jones et al., 2002; Alen et al., 2001). Kingsley et al. (2005), the only study within in this collection to not report significant reductions in pain, randomized 15 FM patients to a strength-training program, while 14 FM patients served as a non-exercising control group. Intervention subjects performed MSA two times per week, including one set of eight to twelve repetitions at 40%—60% of their one repetition max (1RM) and progressing to 60%—80% 1RM by the end of the 12-week trial. Though there were no indications of reductions in pain scores (tender point sensitivity), no increases were reported. Moreover, significant increases in upper and lower body strength ($p < 0.05$) were discovered. Remarkably, seven (47%) of the strength-training group dropped out of the study after the first four weeks. Of the seven, only one cited pain as the reason for leaving the study. The researchers also mentioned that this subject was experiencing a flare up prior to the beginning of the intervention. Among other studies, Hakkinen et al. (2001) investigated the effects of a 21-week progressive MSA program on neuromuscular function and pain in premenopausal women with FM. Neck pain improved significantly, with no significant changes in general pain or number of tender points. Jones et al. (2002) conducted a study investigating the effects of a 12-week MSA program compared to a stretching program of equal length. The researchers reported statistically significant improvements in total myalgic scores, and VAS for pain in the MSA group. Although no significant between-group differences in pain scores were found, effect sizes indicated that the magnitude of change was greater in the MSA group.

Three studies compared the effects of an aerobic intervention to a strength intervention in participants with FM. Each of these studies indicated similar between-group reductions in pain scores along with concomitant improvements in functionality (Kayo et al., 2012; Hooten et al., 2012; Bircan et al., 2008). Kayo et al. (2012) recruited 90 FM patients to participate in a 12-week RCT, involving an MSA group, a walking (WA) group and a non-exercising control group. The researchers noted no significant differences in pain (VAS) scores between the WA and MSA groups ($p = 0.19$), but did note significantly higher pain scores in the control group compared to both the MSA group ($p = 0.03$) and WA group ($p = 0.01$). Pain medication use of the non-exercising control group at the end of the 12-week trial was 80%, compared to 46.7% in the MSA group and 41.4% in the WA group. In as few as three weeks, Hooten et al. (2012) found significant within-group reductions in pain ($p < 0.001$), as measured by the Multidimensional Pain Inventory, among FM subjects performing a progressive MSA program consisting of one set of ten exercises performed five days per week.

Gavi et al. (2014) compared the effects of a 16-week MSA intervention to 16-weeks of flexibility training in individuals with FM. Though both groups demonstrated reduced pain at the end of the trial ($p < 0.05$), the strength-training group showed greater and more rapid reductions in pain ($p < 0.05$).